DPC-10

10 Channel TTL Digital Counter/Timer Board

User Manual

DPC-10

User Manual

Document Part N°	0127-0201
Document Reference	DPC-10\..\0127-0201.Doc
Document Issue Level	1.0
Manual covers PCBs identified	DPC-10 Rev A

All rights reserved. No part of this publication may be reproduced, stored in any retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopied, recorded or otherwise, without the prior permission, in writing, from the publisher. For permission in the UK contact Blue Chip Technology.

Information offered in this manual is correct at the time of printing. Blue Chip Technology accepts no responsibility for any inaccuracies. This information is subject to change without notice.

All trademarks and registered names acknowledged.

Blue Chip Technology Ltd.
Chowley Oak, Tattenhall
Chester, Cheshire
CH3 9EX.
Telephone : 01829 772000 Facsimile : 01829 772001.
Website: http://www.bluechiptechnology.co.uk

Amendment History

Issue Level	Issue Date	Author	Amendment Details
0.7	05.05.89	L.P	First draft
0.8	18.07.97	SEJ	Window front cover and logo
1.0	27/03/01	S ORR	LOGO Updated, Diagrams added

1.0 OUTLINE DESCRIPTION....2
Electromagnetic Compatibility (EMC)....3
EMC Specification....4

2.0 SPECIFICATION....5
2.1 Electrical Specification....5
2.2 Physical Specification....5

3.0 User Adjustments....6
3.1 Selecting the Base Address....6
3.2 Port Map....6

4.0 Electrical Options....7
4.1 Input/Output Connections....7
4.2 Pin Connection Details....7
4.3 Frequency Source Input....8
4.4 On-board Frequency Selection....9
4.5 Interrupts....9
4.6 Opto-isolation....10

5.0 Operating Guide....11
5.1 Software Interface....11
5.2 Programming Guide....11
5.3 Example Program....11

1.0 OUTLINE DESCRIPTION

The DPC-10 board provides two five channel counter-timer devices. Each channel has 16 bit capability and can be used as an event timer, a counter or a frequency generator. Channels can be cascaded to give higher resolution. These devices are particularly powerful and the data sheet should be consulted for the full range of function available.

Electromagnetic Compatibility (EMC)

This product meets the requirements of the European EMC Directive (89/336/EEC) and is eligible to bear the CE mark.

It has been assessed operating in a Blue Chip Technology Icon industrial PC. However, because the board can be installed in a variety of computers, certain conditions have to be applied to ensure that the compatibility is maintained. It meets the requirements for an industrial environment (Class A product) subject to those conditions.

- The board must be installed in a computer system which provides screening suitable for the industrial environment.

- Any recommendations made by the computer system manufacturer/supplier must be complied with regarding earthing and the installation of boards.

- The board must be installed with the backplate securely screwed to the chassis of the computer to ensure good metal-to-metal (i.e. earth) contact.

- Most EMC problems are caused by the external cabling to the board. Boards fitted with IDC ribbon cable connectors on the metal mounting bracket require particularly careful installation of the external cabling. The cabling must be totally screened; the type of ribbon cable which is rolled to a round form with a braided wire screen is best. Standard ribbon cable will not be adquate unless it is contained wholly within the cabinetry housing the industrial PC. The mounting bracket of the board includes a captive nut as a screen earth point. Connect the screen of the cable to this by the shortest possible wire.

- Ensure that the screen of the external cable is bonded to a good RF earth at the remote end of the cable.
- Cables which connect externally to boards at TTL levels should not exceed to two metres in length. This restriction does not apply to opto-isolated boards.

Failure to observe these recommendations may invalidate the EMC compliance.

> Warning
> This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

EMC Specification

A Blue Chip Technology Icon industrial PC fitted with this card meets the following specification:

Emissions:	EN 55022:1995	
	Radiated	Class A
	Conducted	Class A & B
Immunity:	EN 50082-2:1995 incorporating	
	Electrostatic Discharge	IEC 801-2:1984 Performance Criteria B
	Radio Frequency Susceptibility	IEC 801-3:1984 Performance Criteria A
	Fast Burst Transients	IEC 801-4:1988 Performance Criteria B

2.0 SPECIFICATION

2.1 Electrical Specification

Number of channels	10
I/O Logic levels 'ON'	2.4V to 5.5V TTL level
I/O Logic levels 'OFF'	0.0V - 0.8V
Maximum I/O voltage	5V
Maximum count frequency	7MHz
Minimum input pulse width	70nSec
Interrupts	IRQ 2-7 (Selectable)
Opto-isolation	Optional (2 channels)
On-board clock source	4, 2, 1, .5MHz
Bus clock source	Link selectable
Power requirement	5V DC, 150mA
Power dissipation	500mW

2.2 Physical Specification

Height	107mm
Width	15mm
Depth	132mm

3.0 USER ADJUSTMENTS

3.1 Selecting the Base Address

The board may be located in any 62 pin slot in the PC motherboard but must be set up to appear at a specified position (or 'address') in the port map. Available positions are shown in the IBM-PC Technical Reference Guide. However, for those who do not possess a copy of this document, a good place is the location normally allocated to the prototyping card as supplied by IBM. This address is 300 Hex or 768 Decimal.

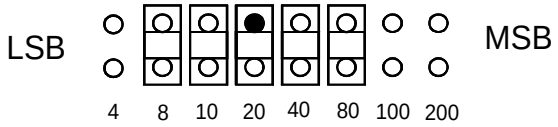
All Blue Chip Technology cards are preset to this address at the factory. However, no two devices should be used while set to the same address since contention will occur and neither board will work. If your machine contains a card with a conflicting address then another reasonably safe address is 200 to 21F (Hex).

A set of links is provided on the board to set the base address of the board within the IBM-PC port map. The address is in binary with the presence of a link representing a 0 and the absence of a link representing a 1.

To set the base address to 768 Decimal (300 Hex), set the following pattern on the links as indicated.:-

Figure 1 - Selecting the Base Address

Note: View board with back panel on RHS.
Middle 8 bit of port address on links.



More example addresses are shown in Appendix A.

Note: No two cards must ocupy the same address.

3.2 Port Map

The DPC-10 card has two 9513 counter/timer chips. Each chip has 5 counter inputs and may be programmed to perform a wide variety of functions. These functions are programmed via an address and data port for each 9513.

The board occupies four read/write addresses (two for each chip) in the IBM-PC port map.

Address	IC	Read	Write
Base + 0	4	Data	Data
Base + 1	4	N/A	Command
Base + 2	5	Data	Data
Base + 3	5	N/A	Command

4.0 ELECTRICAL OPTIONS

4.1 Input/Output Connections

A 50 way insulation displacement connector (IDC) is provided on the PC rear panel of the board for I/O channel signal connection. If access to individual channels is required, a 50 way IDC ribbon cable may be used to connect the I/O channels to a 50 way terminal block available from Blue Chip Technology as Part Number ST-24.

The pins are numbered as shown in the following diagram. Pins 1-48 contain the I/O channels and pins 49 and 50 are connected to digital ground.

When the connector is view from the back of the system odd numbered pins are on the left and even numbered pins are on the right with pin 1 a t the top of the connector.

4.2 Pin Connection Details

Function	Pin	Pin	Function
IC6			IC5
Source 1	1 O	O 2	Source 1
Source 2	3 O	O 4	Source2
Source 3	5 O	O 6	Source 3
Source 4	7 O	O 8	Source 4
Source 5	9 O	O 10	Source 5
Gate 1	11 O	O 12	Gate 1
Gate 2	13 O	O 14	Gate 2
Gate 3	15 O	O 16	Gate 3
Gate 4	17 O	O 18	Gate 4
Gate 5	19 O	O 20	Gate 5
Gate 1A	21 O	O 22	Gate 1A
Gate 2A	23 O	O 24	Gate 2A
Gate 3A	25 O	O 26	Gate 3A
Gate 4A	27 O	O 28	Gate 4A
Gate 5A	29 O	O 30	Gate 5A
Out 1	31 O	O 32	Out 1
Out 2	33 O	O 34	Out 2
Out 3	35 O	O 36	Out 3
Out 4	37 O	O 38	Out 4
Out 5	39 O	O 40	Out 5
Fout	41 O	O 42	Fout
Opt 1 +ve	43 O	O 44	Opt 1 -ve
Opt 2 +ve	45 O	O 46	Opt 2 -ve
+5V	47 O	O 48	+5V
Digital ground	49 O	O 50	Digital ground

Connector Pin View
View with gold edge connectors downwards.

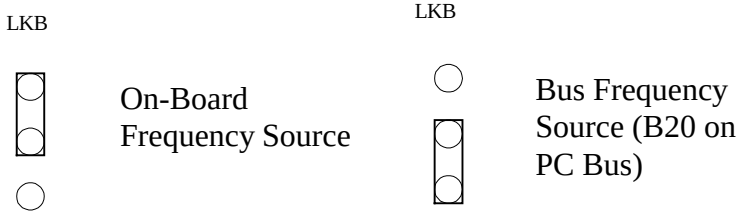
Note: 100mA Max from pins 47+48.

4.3 Frequency Source Input

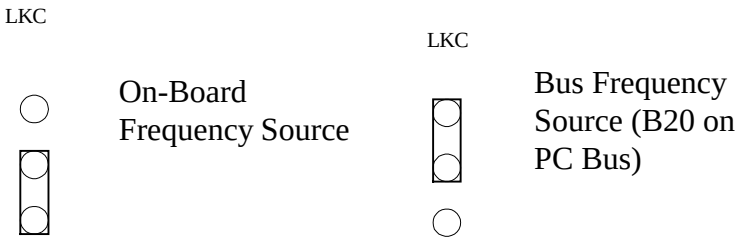
Two possible sources of frequency input are available on the DPC, from the PC bus or from an on-board oscillator. These inputs may be used for interrupt generation, event timing and many other functions. They are fed into the clock input on IC's 5 and 6.

The frequency source is selected for IC5 and IC6 using LKB and LKC respectively, as shown below.

For IC5



For IC6

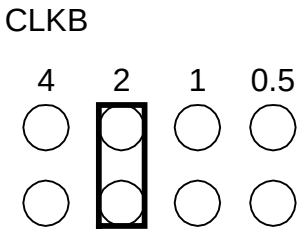


Note that the bus frequency source should be 4.77MHz on all true PC compatibles. Some PC's do not conform to the IBM specification and the bus frequency may be 8MHz or higher. Since this is non-standard the DPC-10 and other cards may not operate correctly in such machines.

4.4 On-board Frequency Selection

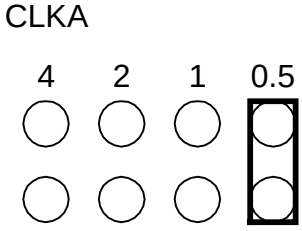
An on-board oscillator (XL1) is provided to give known frequencyes for use by the 9513 chips. These are linked to the clock input on IC5 and IC6 using CLKA and CKLB.

For IC5



This shows a 2MHz input selected for IC5

For IC6



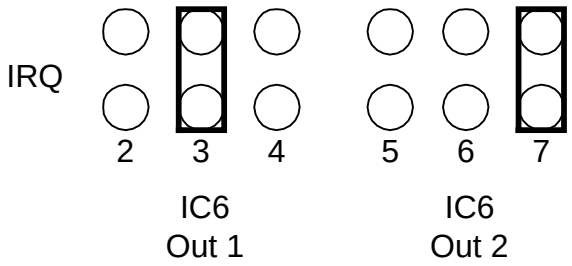
This shows a 0.5MHz input selected for IC6

Note that only one link on JP1 and one on JP2 can be fitted at any one time.

4.5 Interrupts

On IC6 it has been arranged that OUT 1 and OUT 2 channels can be linked to selected interrupt lines.

OUT 1 from IC6 can be linked to IRQ2, 3 or 4
OUT 2 from IC6 can be linked toIRQ 5, 6 or 7, as shown below:



The diagram shows:

OUT 1 from IC6 linked to IRQ 3
OUT 2 from IC6 linked to IRW 7

4.6 Opto-isolation

An option is available to opto-isolate2 inputs. These inputs are connected via pins 43+44 and 45+46 on the IDC connector. (See 4.2)

In order to utilise this facility the user must fir two chips:

IC8 = 74LS14, IC9 = ILCT-6.

The current must be limited (by fitting external resistors) to s auitable level for the opto-isoltors. The value of this resistor must be calculated to ensure that the current passing through thr opto-isolator is limited to 10mA. The opto-isolator will drop 1.5V constantly.

$$\text{REQUIRED RESISTANCE} = \frac{(\text{INPUT VOLTAGE} - 1.5\text{V})}{0.01}$$

The following table gives some common examples using preferred resisitor values:

Input Voltage	Resistor
5V	330R
10V	820R
12V	1K
24V	2K2

The resultant isolated signals appear as OPT 1 and OPT 2 on the board.

OPT 1 (Pins 43+44)
OPT 2 (Pins 45+46)

5.0 OPERATING GUIDE

5.1 Software Interface

The AMD9513 Counter/Timer/Pulse generator chip is a very powerful and complex device. To assist the user in his or her efforts to design software for the DPC-10, we have included a reasonably comprehensive datasheet for the device itself is included in this manual with a copy of the circuit diagram of the board.

5.2 Programming Guide

The AMD9513 chip ports may be accessed using either of the following methods:-

INPUT

(a) Microsoft BASICA or GW BASIC

X=INP (P)

Returns the byte from port P and assigns this value to the variable, X.

(b) 8088/8086 Assembly language

```
PORT EQU    0300H
GETDAT:     MOV    DX,PORT
            IN     AL,DX
            RET
```

OUTPUT

(a) Microsoft BASICA or GW BASIC

OUT P,D

Outputs the byte D to port P

(b) 8088/8086 Assembly language

```
PORT EQU    0300H
PUTDAT:     MOV    DX,PORT
            MOV    AX,DATA
            OUT    DX,AL
            RET
```

5.3 Example Program

The following program in Microsoft BASIC will test the operation of the DPC-10. No connections to the board are necessary to run this program.

```
10      REM DPC-10 TEST PROGRAM DBJDPC.BAS
20      REM BY D. JOHNSON VERS 1.0 01/05/87
30      REM counter 1 decrements at 400Hz its load register is set at          400
40      REM this 1 second terminal count is counted by counter 2 & displayed
50      CLS
60      LOCATE 1,10
70      PRINT "BLUE CHIP TECHNOLOGY DPC-10 TEST PROGRAM VERS 1.0"
80      LOCATE 5,20:PRINT "ENTER BASE ADDRESS OF DPC-10 :";
82      INPUT BASE
90      LOCATE 5,20:PRINT "         COUNT =     seconds
100     OUT BASE+1, &H17
```

```
110     OUT BASE, 0
120     OUT BASE, &HC0
130     OUT BASE+1,&H1
140     OUT BASE, &H32
150     OUT BASE, &HF           'Count F5 down in BCD
160     OUT BASE+1, &H9
170     OUT BASE, &H0
180     OUT BASE, &H4           'Decrement 400 at 400Hz to give1 sec output
182     OUT BASE+1, &H2
184     OUT BASE, 28
186     OUT BASE, 0                     'Counts up the output from counter 1
187     OUT BASE+1, &HA
188     OUT BASE, 0
189     OUT BASE, 0                     'Counter 2 cleared at start
190     OUT BASE+1, &H63                'Load and Arm both counters
200     OUT BASE+1, &HA2                'Save current value in counter
210     OUT BASE+1, &H12                'Read it and convert from BCD
220     LSB=INP (BASE)
230     MSB=INP (BASE)
245     MD=(MSB AND &HF) +10* (MSB AND &HF0) *2^-4
250     LD=(LSB AND &HF) +10* (LSB and &HF0) *2^-4
255     LOCATE 5, 38:PRINT MD*100+LD
260     GOTO 200                        'Repeat.  End with BREAK
```

The above program runs continuously and can only be stopped by pressing Control and Break simultaneously on the PC keyboard.

Whilst every effort has been taken to ensure that the information provided is accurate, Blue Chip Technology cannot assume responsibility for any errors in this manual or their consequences. Should any errors be detected, the company would greatly appreciate being inofrmed of them. A policy of continuos product development is operated, resulting in the contents of this document being subject to change without notice.